**CHAPTER 12 SOLUTIONS**

* 1. *Plausible alternative explanation for causal claim:* Younger generations are more familiar with the Internet as a relatively new technology, and spend more time on it than older generations. With the increasingly universal access to higher education in China in more recent years, younger generations are more likely to have higher levels of education than older generations. Therefore, rather than one’s level of education being a cause of time spent on the Internet, a plausible alternative explanation is one’s age or generational status.
	2. *Plausible alternative explanation for causal claim:*  Because this is a one-sample, pretest-posttest type design without a control group, a number of possible explanations may be offered to explain the gains in reading skills. Among them is the natural maturation of students over the course of the freshman year. Another is that because these students were selected for this course based on their extremely low performance on an initial test of reading skills, a regression to the mean effect may be operating. That is, on re-testing, it is likely that these students’ scores, on average, will regress to the mean, and increase.
	3. *Plausible alternative explanation for causal claim:*  The time of day each group met provides an alternative explanation for the result observed. The students who had their instruction after lunch may be more tired and less able to concentrate than those who had their instruction in the morning. Hence, time of day may be a confounding variable, biasing the estimate of a treatment effect.
	4. *Plausible alternative explanation for causal claim:*  Because the group is voluntary, it may be that those who chose to volunteer have a strong interest in skateboarding and other such activities (paddle boarding, skiing, ice-skating, etc.) that require good balance and they already are quite proficient in balancing. The fact that the researchers found no improvement in these volunteers’ balancing ability after playing the game may be due to a ceiling effect, rather than to a lack of effectiveness of the game itself. That is, if the volunteers’ balancing ability was rather high to start with, their scores at pretest would be near top of the scale, with little room to show any increase on the posttest.
	5. *Plausible alternative explanation for causal claim:*  Although the researchers controlled for a number of relevant variables, by not controlling for the mother’s socio-economic status, the estimate of the treatment effect may very well be biased. Many women work full-time because they need to help support their family’s income; that is, they have lower socio-economic status than families in which the mothers do not work outside the home. The lower socio-economic status may be the real reason for the delayed development in communication skills, rather than the fact of working full-time outside the home itself.
	6. *Plausible alternative explanation for causal claim:* Because the students were all selected from the bottom of the distribution, it is plausible that regression to the mean could explain, in part or whole, the observed increase in test scores at the end of the year.
	7. *Plausible alternative explanation for causal claim:*  Because the experimental group differs from the control groups, Water and Caffeine Free Diet Cocoa Cola, in *both* caffeine and sugar, it is not possible to attribute the increase in short term memory scores to the caffeine alone. It may be the sugar that also or alone is causing the increase.
1. To determine whether supplementation of zinc could reduce frequency rate and duration of common cold during cold season in school aged children living in a low socioeconomc suburb of Mashhad (Altimor), north‐east Iran.
2. It is experimental because children are randomly assigned to the zinc supplemented and placebo groups.
3. To equalize the groups so that both had the same contact with medical staff in order to ensure that the zinc supplementation was the only difference between the two groups.
4. In a double blind experiment, neither the participants nor the researchers know who is in the experimental group and who is in the control group. Because neither the participants nor the treating physicians knew whether the participants were receiving the placebo or the zinc, they were able to rule out other cues and behaviors, as well as potential physician/researcher bias, as the cause of any group differences.
5. Because zinc might work differently for the sexes, so the experimenters controlled for that variable by including equal numbers of males and females.
6. 50. This is a balanced experimental design with 50 males and 50 females in each of the zinc supplemented and control groups.
7. 4.7.
8. Because having a larger family is probably associated with a greater exposure to cold viruses and therefore children from larger families may have a greater frequency of colds regardless of treatment. Researchers tested for differences in the average number of family members in order to rule out this potentially important initial difference between the groups.
9. Independent samples *t*-test.
10. The researchers reported the means and standard deviations for cold occurrence for each group and also the *p*-value associated with the *t*-test. The *p*-value was reported to be < .001.
11. Observational. The students are in intact groups defined by whether or not they have school lunches. They are not assigned randomly into these two groups.
12. Based on this study, there is insufficient evidence that school lunches cause obesity. The difference in obesity may result from any number of other differences between the groups, including the fact that those who eat school lunch might have parents who were too busy to make lunches for them at home because they both worked outside the home and were also not home in time to know or monitor what their sixth grades snacked on after school. As a result, the dietary information about these children might be incomplete. If the children who had school lunches received free or reduced lunch, then another difference between the two groups could be socioeconomic status, which also could contribute to the observed difference in obesity rates between the two groups rather than the school lunches per se.

* 1. Based on this study, there is insufficient evidence that nightlights per se cause nearsightedness. In fact, the results were repudiated the following year by the results of another study (<http://researchnews.osu.edu/archive/nitelite.htm>) that showed that when controlling for the nearsightedness of the parents, there was no relationship between the use of nightlights and children’s nearsightedness. In other words, nearsighted parents tended to make greater use of nightlights for their sleeping babies and that the cause of the nearsightedness in the babies was more likely to be genetic than environmental.

* 1. Three important considerations are described. Others also may be correct. It is important to consider carefully the appropriate outcome measure. A validated and reliable instrument such as the Comprehensive Assessment of Outcomes in a first Statistics course (<https://apps3.cehd.umn.edu/artist/caos.html>) would be preferable to the course final exam. Sarah would like for the classes to be the same on all relevant variables at the outset of the study. Even with random assignment of students to classes, which is not usually an option in an educational setting, the relatively small sample size leaves us concerned about possible initial differences between the groups. One way to control for initial differences in statistics understanding would be to give the assessment as both a pre-test and a post-test measure. Then, Sarah can investigate student gains instead of simply looking at how they did in the end. She would want to control for timing of the class. She does not want one to be after lunch and the other in the morning when students are fresh. Finally, she may want to have a blocked design, blocking on the gender of the student so that we have an equal number of each gender in the study, given the known importance of gender to the outcome. Note: Given that all students in each class form a cluster or cohort of students within that class, in this design students would be considered nested or clustered within classes.  When students are clustered in this way, their responses on the outcome variable may not be independent of each other and, therefore, may violate the independence of observations assumption of the independent groups t-test.  Accordingly, for clustered designs, a different type of analysis would be needed, using what is called, in general, multi-level modeling. This method of analysis is beyond the scope of this book.
	2. Although there are many possible answers to this question, only a few are offered here. Randomly assigning individuals to the two groups would be important to control for initial differences between the two groups that might impact plaque production, such as age and an individual’s natural production of plaque. To control for an individual’s motivation to brush his/her teeth, all individuals randomly assigned to the two groups should have volunteered for the study and show an interest in controlling their plaque. The number of minutes per time spent brushing and the number of times per day spent brushing using the technique assigned needs to be specified and monitored as does the degree to which the individuals in each group faithfully adhere to either the up and down or circular approach. The length of the study needs to be long enough to allow a difference between the two groups to emerge. A study that lasts only one week is likely not to be sufficiently long to allow the different approaches to show an effect. It also would be important to control for the type of toothbrush everyone uses so as to rule out the possibility that it is the type of toothbrush rather than the direction of brushing as the reason for the observed differences in plaque between groups.
1. Dynarski indicates that the causal direction is not established in the study. She points out that it is just as plausible, from the correlation results presented, to conclude that healthier parents are better able to afford a good education for the children, or that a third variable, such as high socioeconomic status is causing both parent longevity and child college attendance.
2. You could determine whether increasing the speed limit from 55 mph to 65 mph on highways has an impact on the number of traffic fatalities by comparing the rate of fatal accidents in states that have 55 mph speed limit policies with those that have 65 mph speed limit policies, for example.